

OUTCOME OF SURAL AND LATERAL SUPRAMALLEOLAR FLAP IN PATIENTS WITH EXPOSED DISTAL TIBIA AND HEEL

Muhammad Arif,¹ Muhammad Azeem,¹ Muhammad Zafar Iqbal,¹ Naseer Ahmed Ch.¹

ABSTRACT

Background: Soft tissue defects around ankle is a challenge for reconstructive surgery. **Objective:** To compare the outcome of sural and lateral supramalleolar flap for soft tissue coverage in patients with exposed distal tibia and heel. **Patients & Methods:** This comparative cross-sectional study was conducted in Department of orthopedic surgery, Bahawal, Victoria Hospital, Bahawalpur from 1st January, 2008 to 31st March, 2009. We included 32 patients which were randomly divided into group A, in whom soft tissue defect was managed by distally based Sural flap and group B, managed by lateral supramalleolar flap. All patients were discharged on 5th post operative day after flap surgery. First follow up in outpatient department was scheduled 10 days after discharge and skin sutures were removed, then all patients were followed on every 5th day for two months. The data was entered and analyzed in SPSS **Results:** Mean age of patients in group A was 36 years and in group B was 31 years. It was noted that 21 (65.6%) patients were having soft tissue defect of heel region while 11 (34.3%) cases were having soft tissue defect of distal tibia. In 30 (93.7%) cases, cause of soft tissue defect was trauma while in 2 (6.6%) patients, chronic osteomyelitis was causing soft tissue defect. Flap survived in all cases of group A while success rate was 94% in group B. Marginal necrosis occurred in 1 (6.6%) patient of group A and 4 (23.5%) patients of group B. Flap was debrided and advanced in all cases. Flap edema occurred in 2 (13.3%) patients of group A and 6 (35.2%) patients of group B that resolved spontaneously by elevating the limb. **Conclusion:** It is concluded that distally based sural flap is a better choice for soft tissue coverage of distal tibia and heel region because it is much reliable and covers a larger area than lateral supramalleolar flap.

Key words: Sural flap, Lateral supramalleolar flap, Soft tissue defect.

INTRODUCTION

Soft tissue defects around the ankle present a major challenge to reconstructive surgeons. Deep skin injuries of distal third of leg will certainly leave tendons, vasculonervous bundles, and bones exposed, which must be protected with good quality and good vascularization tissues so as to prevent deep infections and deterioration of such structures. Providing adequate soft tissue coverage to this area and heel, is always difficult for reconstructive surgeons.¹

Multiple options ranging from simple skin graft to technically demanding free microvascular flaps are now available. Different types of local flaps are available e.g. Local Island, Lateral Malleolar Flap, Dorsalis pedis artery flap, medial plantar artery flap and lateral calcaneal flaps are local flaps.² Cross leg flaps have also been used for this

difficult region but now these are not considered a good option because of difficult posture and difficulty in rehabilitation of the patient.³ Reconstruction with free microvascular flap is a good option but it is a lengthy procedure; trained microvascular surgeon and expensive equipments are required.⁴

Reverse flow fasciocutaneous flaps with one of the major leg arteries in their pedicle have been described. These include reverse flow peroneal, anterior tibial and posterior tibial artery flaps.⁵ The lateral supramalleolar flap was described in 1988, thereby expanding the armamentarium of locoregional flaps for coverage of the ankle and foot.⁶ The peroneal artery, in its distal course behind the tibiofibular angle, provides a perforating branch that traverses the interosseous membrane. This branch provides multiple ascending branches to the overlying skin. At the premalleolar region, is an anastomotic junction between the anterolateral malleolar artery (branch of the anterior tibial artery) and the perforating branch of the peroneal artery. The flap, vascularized by a cutaneous branch arising from the perforating ramus of the peroneal artery, is raised on a retrograde vascular flow. Distally based sural flap was first described by Mosquetelet et al in 1992.⁷ It is a fasciocutaneous flap which is fed by

1. Orthopaedic Surgery, Sheikh Zayed Medical College/Hospital, Rahim Yar Khan. University of Health Sciences Lahore.

Correspondence: Dr. Muhammad Arif, SR. Orthopaedic Department, Sheikh Zayed Medical College / Hospital, R.Y. Khan, University of Health Sciences, Lahore.

Email: arifsomro@hotmail.com
Phone: 0333-6463353

perforators of peroneal artery in reverse fashion. Vascular basis of this flap is close association between median superficial sural artery and peroneal artery perforators, which make it an axial pattern reverse flow flap. Fasciocutaneous flaps are highly effective and easy to perform. The objective of this study was to compare the outcome of sural and lateral supramalleolar flap for soft tissue coverage in patients with exposed distal tibia and heel.

PATIENTS AND METHODS

This comparative cross-sectional study was conducted on 32 patients of either sex, ranging from 15-50 years having soft tissue defect of distal tibia and heel region. These patients were divided in two groups. In Group A, soft tissue coverage was carried out with sural fasciocutaneous flap on 15 patients while in Group B, 17 patients were managed by lateral supra malleolar flap. All patients were discharged on 5th post operative day after flap surgery. Patient as well as attendants were given detailed information regarding the care of newly constructed flap. First follow up in out patient department was scheduled 10 days after discharge and skin sutures were removed, then all patients were followed on every 5th day for two months. Peninsular design with cutaneous pedicle was used in all cases. Operation was performed under general or spinal anesthesia. Patient was kept in lateral or prone position. A tourniquet was applied and inflated before the elevation of flap. In Group A, flap was marked from posterior lower third of leg and pedicle was marked along the lateral border of Achilles tendon medially and the margin of fibular shaft laterally about 05cm from tip of lateral malleolus. The dissection was started proximally by incising the skin and fascia. Sural nerve, sural superficial artery and short saphenous vein were identified, divided and ligated, deep fascia was sutured to the skin paddle and elevated from the muscle. Pedicle was freed about 05cm about the tip of lateral malleolus and flap was rotated to cover the raw area. In Group B, flap was marked on lower half of the lateral aspect of leg, superiorly up to middle of leg, anteriorly up to tibialis anterior, posteriorly up to fibular crest, inferiorly including the tibiofibular space, marked by depression in the lower part of tibiofibular space. Once the flap is raised, it must rest spontaneously in the defect after rotation with out

any tension. The donor area was reduced in size by absorbable sutures and covered with split thickness grafts. The data was entered and analyzed in SPSS version 12.

RESULTS

Thirty two patients were included in the study. Mean age of 15 patients in group A was 36 years and 17 patients in group B was 31 years. There were 29 male and 3 female patients. 21 (65.6%) patients were having soft tissue defect of heel region while 11 (34.3%) cases were having soft tissue defect of distal tibia (Table I). In 30 (93.7%) cases, cause of soft tissue defect was trauma while in 2 (6.6%) patients, chronic osteomyelitis was causing soft tissue defect. Most commonly involved region was heel and trauma was the most frequent cause as shown in table I and II. Marginal necrosis occurred in 1 (6.6%) patient of group A and 4 (23.5%) patients of group B. Flap edema occurred in 2 (13.3%) patients of group A and 6 (35.2%) patients of group B. Flap survived in all cases of Group A while failure encountered in one case of Group B. 8 (47%) patients in Group B complained of anesthesia which was already explained to them. 1(6.6%) patient in Group A while 3 (17.6%) patients in Group B complained of difficulty in wearing shoes due to bulkiness of flaps. (Table III).

Table I: Location of soft tissue defect.

Location of Soft Tissue defect	Group A n=15	Group B n=17
Heel region	9(60%)	12(70.5%)
Distal tibia	6(40%)	5(29.4%)

Table II: Causes of soft tissue defects of distal tibia and heel region.

Causes of Soft Tissue Defects	Group A n=15	Group B n=17
Trauma	14(93.3%)	16(94.1%)
Chronic oteomyelitis	1(6.6%)	1(5.8%)

Table III: Frequency of Complications in two Groups.

Frequency of Complications	Group A n=15	Group B n=17
Marginal necrosis	1(6.6%)	4 (23.5%)
Flap edema	2 (13.3%)	6 (35.2%)
CoMplaint of anesthesia	0	8 (47%)
Difficulty in wearing shoes	1(6.6%)	3 (17.6%)
Flap failure	0	1(5.8%)

DISCUSSION

Skin coverage of distal third of tibia remains a challenge for reconstructive surgery. In this segment, there are no interposing muscle tissues around critical structures and this has limited extensibility and mobility. These characteristics make the random use of skin grafts and rotational patches inappropriate for soft tissue coverage. Thus, relying on more complex procedures such as microsurgical techniques⁸ or reverse flow island of pedicled patches is required.⁹

Relatively few procedures for cutaneous coverage of these regions are effective with low morbidity. Local flaps have limited reach. Lateral calcaneal artery flap is useful for covering small defects over the posterior heel.¹⁰ A modified V-Y advancement version of this flap has been reported with primary closure of the donor area.¹¹

Medial Plantar artery flap is considered appropriate for weight bearing heel.² Dorsalis pedis artery flaps can be based distally or proximally.¹² Local muscles flaps are of restricted use.¹³ They are related with additional trauma to already insulted regions and in cases of flap failure extent of local damage will greatly increase. Distally based fasciocutaneous flap with a major vessel in their pedicle have been described for all three major leg vessels.¹⁴ Sacrifice of one major vessel is an obvious disadvantage. Free flaps are considered good weight absorbant that resist to full thickness ulceration.¹⁵

Masquelet et al, reported a detailed study of the vascular channel accompanying superficial nerves in the leg. Using colored latex injection in fresh cadavers.⁷ He observed that vascular axis of each nerve in the leg gives multiple cutaneous branches along the superficial course of the nerve. Each superficial nerve follows the course of corresponding deep artery and there are regular anastomosis between the deep artery and vascular axis of the corresponding superficial nerve. The flaps were named neurocutaneous flap. Lateral supramalleolar neurocutaneous flap was described by Masquelet, with clinical experience of 14 cases that allowed the coverage of lateral, dorsal and plantar aspect of foot, the posterior heel and the lower medial portion of leg.⁶

A detailed study reported the vascular channel accompanying superficial nerves in the leg. The flap was named neurocutaneous flap and only one

distally based neurocutaneous flaps of the sural nerve was reported in this series. First major series of distally based superficial sural artery flap was published by Hasegawa et al.¹⁶ Many of the patients in the series of Hasegawa et al, were paraplegic and managed for pressure sores around the ankle and posterior heel. Bocchi et al, made comparison between reverse fasciocutaneous flap and distally pedicled sural island flap for distal third of leg & he concluded that sural flap was far better choice for moderate size of wounds¹⁷ as depicted in present study.

The lateral supramalleolar, sural and pedicled perforating vessels patches have similar applications, but present individual technical peculiarities. The lateral supramalleolar patch, described by Masquelet⁶ raised little interest from other authors because of difficult dissection, smaller size and high complication rate and this was evident from our study as well.

In our study, 23.5% partial necrosis was detected that is comparable to Touam et al.¹ In a comparative study between lateral supramalleolar flap and the sural one, described an incidence of partial and total necrosis of 18.5% for the lateral supramalleolar patch. Defects in our series were confined to lower leg, ankle and heel. We have found reverse sural flap was the better of the two because it is a versatile and reliable flap that is easy, quick and safer to dissect.^{18,19}

CONCLUSION

The distally based sural neurocutaneous flap is the method of choice for covering skin defects over the heel and distal tibia. The lateral supramalleolar artery flap is indicated only when the sural neurocutaneous flap is contraindicated.

REFERENCES

1. Touam C, Rostoucher P, Bhatia A, Oberlin C. Comparative study of two series of distally based fasciocutaneous flaps for coverage of the lower one-fourth of leg, the ankle, and the foot. *Plast Reconstr Surg* 2001; 107: 383-92.
2. Koshima, I, Itoh, S, Nanba, Y, Tsutsui, T, Takahashi, Y. Medial and lateral malleolar perforator flaps for repair of defects around the ankle. *Ann Plast Surg* 2003;51; 579-83.
3. Geddes CR, Morris SF, Neligan PC. Perforator flaps: evolution, classification and applications. *Ann Plast Surg* 2003;50:90-9.
4. Hong G, Steffens, and Wang FB. Reconstruction of the lower leg and foot with the reverse pedicled posterior tibial fasciocutaneous flap. *Br J Plast Surg* 1989; 42: 512-16.
5. Rohmiller MT, Callahan BS. The Reverse Sural Neurocutaneous Flap for Hindfoot and Ankle

- Coverage: Experience and Review of the Literature. *Orthopedics* 2005; 28: 1449-53.
6. Masquelet AC, Beveridge J, Romana C, Gerber C. The lateral supramalleolar flap. *Plast Reconstr Surg* 1988; 81:74-8.
 7. Masquelet AC, Romana MC, Wolf G. Skin island flaps supplied by the vascular axis of the sensitive superficial nerves: anatomic study and clinical experience in the leg. *Plast Reconstr Surg* 1992; 89: 1115-21.
 8. Heller L, Levin LS. Lower extremity microsurgical reconstruction. *Plast Reconstr Surg* 2001; 108:1029-1041.
 9. Ahmed SK, Fung BK, Ip WY, Fok M, Chow SP. The versatile reverse flow sural artery neurocutaneous flap: A case series and review of literature. *J Orthop Surg Res* 2008;3:1520.
 10. Koshima, I, Itoh, S, Nanba, Y, Tsutsui, T, Takahashi, Y. Medial and lateral malleolar perforator flaps for repair of defects around the ankle. *Ann Plast Surg* 2003;51: 579-83.
 11. Hayashi A, and Marnyama Y. Stepladder V-Y advancement flap for repair of postero-plantar heel ulcers. *Br J Plast Surg* 1997; 50: 657-661.
 12. EL_Khatib, Hamdy A. Adipofascial turn-over flap based on perforators of the dorsalis pedis for resurfacing forefoot defects: An anatomic and clinical approach *plast reconstr surg*. 1998;102:393-397.
 13. Noszezyk BH. The origin of the concept of muscle flaps. *Br J Plast Surg*. 1996; 49: 107.
 14. Rocha JFR, Gilbert A, Masquelet A, Yousaf NJ, Sanger JR. The anterior tibial artery flap: Anatomic study and clinical applications. *Plast Reconstr Surg* 1987; 79: 396-404.
 15. Santanelli F, Tenna S, Pace A, Scuderi N. Free flap reconstruction of the sole of the foot with or without sensory nerve coaptation. *Plast Reconstr Surg* 2002;109:2314-22.
 16. Hasegawa M, Torii S, Katoh H, Esaki S. The distally based superficial sural flap. *Plast Reconstr Surg* 1994; 93: 1012-20.
 17. Bocchi A, Merelli S, Morellini A, Baldassarre S, Caleffi E, Papadia F. Reverse fasciosubcutaneous flap versus distally pedicled sural island flap: two elective methods for distal-third leg reconstruction. *Ann Plast Surg* 2000; 45: 284-91.
 18. Ajmal S, Ayub Khan MA, Khan RA, Shadman M, Yousof K, Iqbal T. Distally based sural fasciocutaneous flap for soft tissue reconstruction of the distal leg, ankle and foot defects. *J Ayub Med Coll* 2009;21:19-23.
 19. Hamdi MF, Kalti O, Khelifi A. Experience with the Distally Based Sural Flap: A Review of 25 Cases. *J Foot & Ankle Surgery* 2012; 51: 627-631.